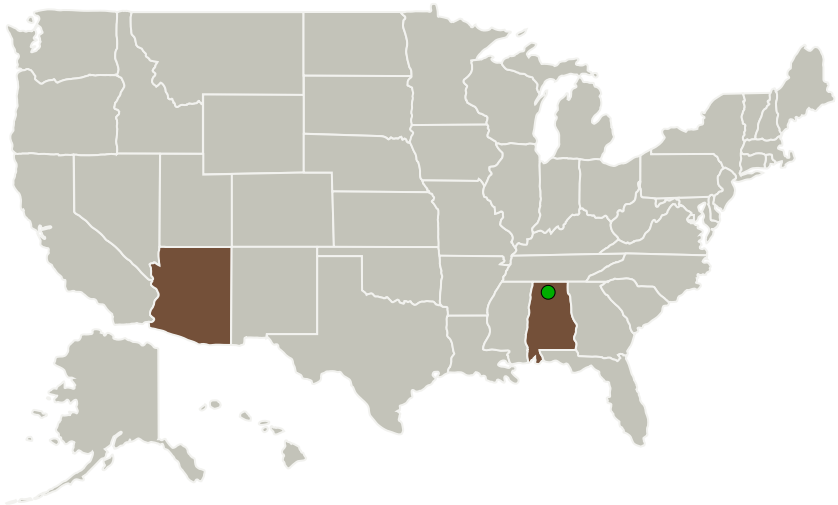
Fabric, Inflated, Insulating Shroud for Cryogenic In-Space Transportation, Phase II

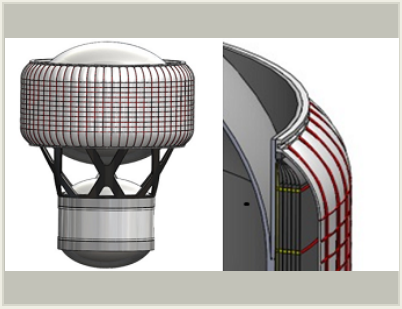
Completed Technology Project (2016 - 2019)

Project Introduction

The Cryogenic Encapsulating Launch Shroud and Insulated Upper Stage (CELSIUS) innovative layered system combines functions of Multi-Layer Insulation (MLI), Micro-Meteoroid and Orbital Debris (MMOD) protection, and fairing functions (exposure to free stream) into a deterministic soft-goods system that provides far greater performance for far less mass than the equivalent State of the Art (SOTA) systems performing the same functions. CELSIUS provides nearly perfect radiation dominated thermal performance. A 5 layer system MLI/MMOD system limits heat load to a cryogen to <0.5 W/m ^2 and gives >95% probability of no penetration for a two year mission in low Earth orbit and is readily scalable to other mission types. The system is applicable to large structures, including cryogenic tanks. Furthermore CELSIUS is robust enough to tolerate the vibrations, load, dynamic pressures, and heating of the launch ascent environment allowing it to protect nearly any portion of the launch stack up to and including serving as a complete launch fairing. Our Phase II effort matures the concept through analysis, design, subscale test and validation activities; including simulation of the highest risk areas of free-stream exposer and vibration at launch followed by system deployment while at cryogenic cold-soak. This effort significantly improves the TRL of the system and we exit Phase II with complete validation and having completed a Preliminary Design cycle in support of technology insertion onto the SLS EUS.

Primary U.S. Work Locations and Key Partners





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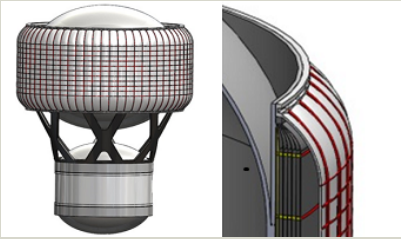
Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Arizona

Images



Briefing Chart Image
Fabric, Inflated, Insulating Shroud for Cryogenic In-Space Transportation, Phase II
(https://techport.nasa.gov/image/126270)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Paragon Space Development Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

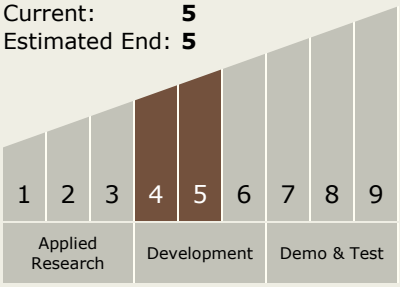
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Chad E Bower

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System